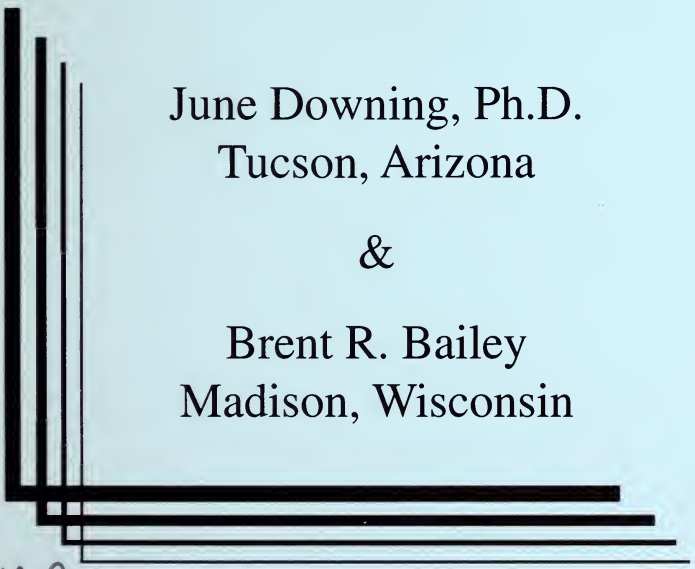
Jane Bartley

Helping Young Children With Visual Impairments Make Use of Their Vision



June Downing, Ph.D.
Tucson, Arizona

&

Brent R. Bailey
Madison, Wisconsin

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Blumberg Center for Interdisciplinary
Studies in Special Education

Indiana State University 1993

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Introduction

The purpose of this manual is to help parents understand the role vision plays in the learning process of their child with a severe visual impairment. The information and ideas presented in this manual are meant only as guidelines. This manual is not intended to tell parents what to do. Rather it offers suggestions about ways children can be helped to make better use of their vision in order to learn. Deciding on a course of action must be made by each family, based on their own individual situations.

This manual is for parents of young children seven and under who have a visual impairment. Some of these children may have physical and intellectual disabilities, as well as a visual impairment. Other children may have just a visual impairment, but one that is very severe. In either case, the children discussed will have some difficulty making use of visual information. Since parents play a critical role in their child's overall development, their assistance in helping the child learn visual skills is of utmost importance.

For ease in reading, some common questions about vision and accompanying answers are presented. The responses to these questions address children of preschool and early elementary age. However, much of the information presented can be applied to any age individual. Although the explanations and suggestions presented have general applicability to older children and adults experiencing a visual impairment, the authors caution against assuming the needs of older populations will be the same as those of young children whose visual systems are still developing. Older populations of children and adults require learning experiences that are age-appropriate and meaningful.

How Does My Child Learn?

The vast majority of what we learn happens as we watch what others do around us. Hearing, taste, touch, and smell all provide important information about the world, but none of these can compete with the visual sense. Vision helps people gain detailed information in a manner that is both quick and efficient.

The majority of individuals with a significant visual loss, still use their vision to learn. Children with severe visual impairments learn just like other children by exploring, interacting with people and things, repeating experiences so they can be remembered, and by being expected to learn. Even small amounts of vision can be used effectively to gain considerable information. For instance, a child who can detect light may use the information to help move toward the sunlight coming in an open door. This same child also may be able to locate toys made of some highly reflective material displayed on a dark rug. When using vision is not possible, a child will need to adapt by using other sense modalities (hearing, touch, smell, movement, and taste). Learning may take longer and experiences may have to be more structured and repeated, but learning can and will occur.

How Do I Know If My Child Has A Visual Impairment?

Parents often are the first ones to detect if their child has a visual problem. If a child normally notices a colorful and interesting toy only when it is placed in a certain position; if a child typically overreaches or underreaches for objects; if a child explores the environment with her hands instead of her eyes; if a child brings things very close to her face to look at, or if she flaps her hands very close to her eyes, she may have a visual loss. Basically, any behavior that suggests the child is adapting for a lack of vision could signal a need to have the child's vision thoroughly examined. Appendix A provides a more comprehensive list of behaviors that may represent a visual problem.

The best people to help determine if a child has a visual impairment are professionals in the field of visual abilities and visual losses. A clinical examination from an ophthalmologist or optometrist will provide specific information related to the child's *physical* ability to see. This examination will provide information on the health of the visual system in general and a prognosis for the child's ability to use vision in the future. This examination does require some cooperation between the child and doctor. Carefully choosing an optometrist or ophthalmologist with experience working with young children and/or children with multiple disabilities is very important. Finding a doctor with whom both parent and child are comfortable is important.

Children with severe visual impairments also may benefit from a functional vision assessment. This form of assessment does not require the child to sit quietly in a clinical setting

and tolerate looking into unfamiliar pieces of equipment. Rather, it takes place through observing the child as she participates in typical activities. For example, when the child is getting dressed at home or playing with a sibling in the living room, the child's actions (using vision or not using vision) are observed to determine visual strengths as well as needs. A teacher trained in functional vision assessments can help parents find ways to support their child's visual behavior. A more thorough and accurate diagnosis also may be possible when this information is shared with an optometrist or ophthalmologist .

What Does My Child See?

The answer to this question varies from child to child. How well a child sees depends on many factors including: 1) the actual physical condition of the eye and visual system; 2) environmental conditions, such as lighting; 3) the effect of any medications the child may be taking; 4) past experiences using vision; 5) how the child is feeling at that given time; and 6) whether the child is expected to try to use vision. The important thing to remember is that no two children see exactly alike and that the label given to the visual deficit cannot determine how well a child learns to make use of what is seen. Appendix B lists brief explanations for a number of visual conditions. The description of these various visual conditions will provide some information of how a child *might* see. However, as stated before, other factors will play a role in how well a child actually sees and uses visual information.

Can I Help My Child To See Better?

Though it may not be possible to physically change the eye and the visual system, it may be possible to help a child visually *detect* what is present. It is always important to make sure that a child's vision has been "corrected," as determined by an ophthalmologist or optometrist. This may be achieved through surgery, medication, and/or corrective lenses. Once maximal correction has been achieved, certain environmental changes may improve the child's ability to discern things visually. Colorful items that reflect light (e.g., bright yellow) are easier to see than dark or pale items. Quality lighting that brightens what is to be seen also can help a child see things missed in a dimly lighted area. Sometimes bringing an item closer to the child can assist with visual detection. Increasing background contrast is another technique that may prove helpful to some children.

Helping a child make simple adaptations in the environment may impact a child's ability to see both now and in the future. For example, sliced oranges in an orange bowl may make it difficult for the child to see the fruit slices. Placing the orange slices on a dark blue plate increases contrast between the two colors and the child has a better chance of seeing each piece of fruit. Avoiding situations that cause glare or putting on sunglasses when going out into bright sunlight so that excessive light does not make it difficult to see also can assist a child to detect information visually. Sometimes adding movement to objects can serve to draw a child's attention in the desired direction. For example, it is usually easier to detect a rabbit that suddenly jumps from

hiding and runs than to see the same rabbit sitting motionless. Movement can often make detection easier and once visual attention has been achieved, the child may be able to visually fixate.

Finally, drawing a child's visual attention may be done through other senses. A parent may ask a child questions, point where to look, or explain what there is to see (e.g., "Wow! Do you see that pretty red bird?"). Directing the child's visual attention by using prompts and cues is very common and helps to make sure that both parent and child are looking at the same thing. This may be very important for the child with a severe visual impairment who can miss a great deal of incidental visual information unless specifically directed to look for it. Even if a child does not fully understand what is said, sound can be added to the object to help draw visual attention (e.g., tapping a toy).

Although many environmental changes can be made to improve visual detection (i.e., recognizing that something is there), it is a good idea to keep changes as natural as possible. For example, having a child work in a dark room with a very bright light may help the child look at the light. However, looking at light is only a beginning. Unless that child learns to look at people and real objects outside the dark room, opportunities to use this visual detection skill are useless in the real world. Most environments have some form of lighting and many contain visual distractions. Helping a child function in typical environments with more subtle adaptations (e.g., enhancing background contrast) will allow a child to develop efficient visual skills when and where they are needed.

What Is The Best Way To Help My Child Understand What Is Seen?

Some children may be able to detect that something is present (e.g., see a shape or a bright color), but have no idea what they are seeing. When children are looking at something, parents should not assume that children automatically understand what it is. Understanding what we see is a process that occurs over time as we grow from an infant to a young child. The experience of learning what is seen requires interaction. A parent can guide learning by making sure that the child is an active participant in daily routines and is able to make use of what is seen. The child will need encouragement to reach out, explore, and manipulate items seen. If the child can hear, telling the child what the child is experiencing can help make meaningful connections. For instance, a child may not be able to see the features of an object clearly. However, if a parent is consistent in using words, presenting activities, and supporting a child, the child may learn to pair what can be seen with the words the parent uses to describe meaningful objects and activities. For example, a family dog may only be detected as movement at a certain height off the floor. Yet if the child touches this "movement" and interacts with this "movement," the visual detection of this "movement" can become recognized as the family dog. The child may not be able to clearly see the dog, but can still "recognize" the dog.

The important aspects of teaching a child to use available vision are consistency, repeating information and using a positive approach while providing many regular opportunities

to encourage vision use. Make life visually functional, meaningful, and enjoyable. For instance, if a child picks a snack from two different choices and one is preferred to the other, the child may be motivated to learn what differentiates the two snack options. A parent can assist the child to get what he wants by making sure the two snacks look different in shape, size, or color, (e.g., a red apple versus a box of crackerjacks), or by placing them on two different colored plates.

When Is The Best Time To Teach My Child To Use Vision?

It is best to teach during the normal routine of the day's activities. Since we are constantly making use of visual information, the best time to help a child learn to use vision is whenever a need naturally arises.

Some activities that children engage in may not *require* the use of vision (e.g., taking a bath, eating, or listening to music). Other activities may not *require* vision, but are made easier or more enjoyable with vision (e.g., watching cartoons, putting on pants, or picking out cereal in the grocery store). If a child seems to be having difficulty in an activity and if use of vision could help participation, then the parent may want to offer ways to make what is seen more visible or encourage the child to look.

Although special times may be set aside to work on using vision, it is just as important that children receive assistance

to see and make use of visual information throughout the activities in a typical day. The instruction that fits naturally into the child's daily life and is provided when and where it is needed will be most beneficial, motivating and reinforcing.

Who Can Help With This Learning Process?

Any member of the child's educational team can offer assistance as part of this learning process. A child's team includes parents, other family members, friends, teachers, support personnel (such as an occupational therapist, a physical therapist, a vision specialist, an orientation and mobility instructor, a speech and language pathologist, a hearing specialist) and anyone else who has skills, knowledge and interest. Problem solving and creative ideas can and should come from any team member.

Team members need to be aware of the child's visual strengths, the visual impairment, and the child's personal preferences. Team members should help decide when and where the use of vision might be helpful and *how* best to help the child detect information visually, and determine its meaning. Learning to make effective use of visual information can happen anytime strategies to enhance the child's visual functioning are applied. Communication among team members is the key to keeping vision instruction consistent and meaningful.

Where Can I Get More Information?

Many organizations exist that provide services to people with visual impairments. Information about these organizations is typically free of charge and requires only a phone contact or letter of request. Information may be about prevention, advocacy, legal rights, adapted aids, videotapes, books and other materials. Appendix C is a resource list about organizations that provide services to individuals with visual impairments. Appendix D includes additional information on how the visual system works, parts of the eye, and basic visual skills. Appendix E provides a list of terms commonly used by vision specialists and may often appear on eye reports. This information may help parents work with their children to use visual information that promotes *Learning To Look.*

APPENDIX A: Behaviors Representing A Potential Visual Problem

When To Suspect A Vision Impairment

The following observable behaviors and conditions may mean there is a vision problem.

Appearance:

- Red rimmed eyelids.
- Swollen eyelids.
- Crust near lashes.
- Frequent sties.
- Red or watery eyes.
- Eyes in constant motion.
- Crossed eyes or one eye turning in and the other eye out.
- Eyes that cross when the child is tired.
- Eyes with pupils of different sizes.
- Unusual appearance of the eyes.

Behavior:

- Blinks eyes constantly or rubs eye often.
- Tends to have eyes crossed when reading.
- Seems overly sensitive to light.
- Stumbles or trips over objects.
- Holds book "too close" or "too far away" when reading.
- Frequently changes distance of book from far to near when reading.
- Shuts or closes one eye when reading.
- Tilts head to one side when reading.
- Screws up face when reading.
- Frowns or holds body tense when trying to see distant objects.
- Reads only brief periods without stopping.
- Has short attention span when doing chalkboard, bulletin board, or map work.

Symptoms	*Condition*
•Squints •Gets close to blackboard	**Nearsightedness** The inability to see clearly at a distance.
•Rubs eyes •Has watery eyes •Complains of blurred vision	**Farsightedness** The inability to see clearly close-up.
•Rubs eyes •Has watery eyes •Complains of blurred vision	**Astigmatism** This condition causes blurred vision at a distance *and* close-up.
•Has intermittent double vision •Closes or covers one eye •Says letters or words appear to move •Loses place •Is inattentive •Rubs eyes •Has watery eyes •Complains of blurred vision	**Teaming disorders** (binocular vision) A variety of conditions in which the eyes tend to drift inward, outward, or upward.
•Has poor reading comprehension •Has blurred vision when looking from blackboard to book or vice versa. •Holds things very close •Has headaches when reading •Is tired at the end of the day •Is inattentive •Rubs eyes •Has watery eyes •Complains of blurred vision	**Focusing disorders** (accommodation) The inability to contract or relax the eyes' focusing muscles.
•Has poor reading comprehension •Moves head excessively when reading •Loses place frequently •Skips lines when reading •Uses finger to keep place •Has poor reading comprehension •Has short attention span	**Tracking disorders** (saccadic dysfunction) Inadequate ability to scan along a line of print and move the eyes from one point in space to another.

APPENDIX B: Common Visual Impairments

Overview of Common Visual Impairments

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
Achromatopsia (total color blindness)	Retina (cone malformation)	Hereditary	Decreased visual acuity to 20/200, extreme light sensitivity, and nystagmus. Visual fields are normal.	Optical aids, sunglasses, and dim illumination.	Nonprogressive; nystagmus and photophobia (light sensitivity) reduce with age.
Albinism (total or partial lack of pigment)	Macula (underdeveloped)	Hereditary	Decreased visual acuity (20/200 to 20/70), nystagmus, photophobia, high refractive error, and astigmatism. Visual fields variable and color vision is normal	Painted or pin-hole contact lenses, absorptive lenses, optical aids, and dim illumination.	Nonprogressive.

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
Aniridia	Iris (underdeveloped)	Hereditary	Decreased visual acuity, photophobia, possible nystagmus, cataracts, displaced lens, and underdeveloped retina. Visual fields are normal. Secondary complication: glaucoma, with accompanying constriction of the visual fields, squint, and lens opacification.	Pin-hole contact lenses, sunglasses, optical aids, and dim illumination.	Milder forms develop slowly, progressive cataracts; severe forms develop glaucoma and corneal opacification.
Cataracts (congenital)	Lens (opacity)	Hereditary, congenital anomalies (rubella, Marfan syndrome,	Decreased visual acuity, blurred vision nystagmus, squint, photophobia, slight constriction in the	Surgery as early as possible in cases of severe visual impairment.	After surgery, inability to accommodate; problems with glare which are corrected with glasses or contact lenses.

(CONTINUED)

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
		Down syndrome), infection or drugs during pregnancy, and severe malnutrition during pregnancy.	peripheral visual fields is possible, but visual fields are generally normal.		Complications from surgery: secondary cataracts and detachment of the vitreous or retina.
Cataracts (senile)	Lens (opacity)	Age	Progressively blurred vision; near vision is better than distance vision.	Surgery, with resultant cataract glasses, contact lenses, lens implant (IOL, introacular lens).	Same as for congenital cataracts. Complications from surgery: glaucoma, retinal detachment, hemorrhage of the vitreous, infection. Better candidate for intraocular lens (IOL) implants

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
Cataracts (traumatic)	Lens (opacity)	Head injury or metallic foreign body in the eye	Blurred vision, redness and inflammation of the eye, and decreased visual acuity. Complications: infection, uveitis, retinal detachment, and glaucoma.	Surgery after inflammation subsides.	Same as for congenital and senile cataracts.
Coloboma	Various parts of the eye may have been deformed, severity depending on when deformity occurred during development.	Hereditary	Decreased visual acuity, nystagmus, strabismus, photophobia, and loss of visual and superior fields. Secondary complication: cataracts. Associated conditions: microphthalmia, polydactyly, and mental retardation.	Cosmetic contact lenses, sunglasses, and optical aids.	Usually fairly stable.

(CONTINUED)

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
			Associated conditions: mental retardation, cardiac abnormalities, hypotonia, saddle-shaped nose, large protruding tongue, and a short, squat stature.		
Glaucoma (congenital)	Tissues of the eye damaged from increased intraocular pressure.	Hereditary	Excessive tearing, photophobia, opacity or haze on lens, buphthalmos, poor visual acuity, and constricted visual fields.	Eye drops; surgery as soon as possible to prevent extensive damage.	With treatment, depends on the innate resistance of the structures of the eye. Blindness if not treated.
Glaucoma (adult)	Same as for congenital glaucoma.	Hereditary or the result of changes in the eye after surgery.	Headaches in front portion of the head, especially in the morning; seeing halos around lights;	Eye drops, optical aids, sunglasses.	Same as for congenital glaucoma.

(CONTINUED)

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
			decreased visual acuity, loss of visual fields, photophobia, and constricted peripheral fields in severe cases.		
Glaucoma (acute attack)	Same as for congenital and adult glaucoma.	Inability of the aqueous to drain.	Nausea, severe redness of the eye, headache, and severe pain.	Emergency surgery.	Without emergency surgery, permanent damage to the ocular tissues and loss of visual acuity and peripheral vision.
Hyperopia (Farsightedness)	Small size of the eye, weak refractive power of lens.	Hereditary	Decreased visual acuity for close work, normal visual field.	Prescription correction.	May improve as the eye grows.
Keratoconus	Cornea (stretched to a cone shape)	Hereditary. Manifested in second decade.	Increased distortion of entire visual field; progressive decrease in visual acuity,	Hard contact lenses in the early stages; keratoplasty (corneal transplant) as needed	Without keratoplasty, progressive degenerative thinning of cornea until cornea ruptures

(CONTINUED)

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
			especially in the distance. Associated conditions: retinitis pigmentosa, aniridia, Down syndrome, and Marfan syndrome.		and blindness ensues.
Myopia (nearsighted-ness)	Elongation of the eye; stretching of the posterior of the eye.	Hereditary	Decreased visual acuity in the distance, vitreous floaters, metamorphopsia. Normal visual field unless retina is detached. Secondary complications: retinal detachment and swelling or hemor-rhaging of the macula.	Prescription correction, prefer-ably contact lenses; optical aids and high illumination, surgical procedure on the cornea.	Unpredictable rate of progression.
Optic Atrophy	Optic nerve	Hereditary, disease	Loss of visual acuity, changes in visual fields, total blindness.	Prevent the cause of the atrophy.	Degenerative.

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
Retinal Detachment	Retina (portions detach from supporting structure and atrophy).	Numerous, including diabetes, diabetic retinopathy, degenerative myopia, and a blow to the head	Appearance of flashing lights; sharp, stabbing pain in the eye; visual field loss; micropsia, color defects, and decreased visual acuity if the macula is affected.	Laser-beam surgery and cryosurgery, depending on the type and cause of the detachment; optical aids; and usually high illumination.	Guarded
Retinitis Pigmentosa	Retina (degenerative pigmentary condition).	Hereditary	Decreased visual acuity, photophobia, constriction of the visual fields, (loss in the peripheral field), and night blindness. Usher Syndrome, Laurence-Moon-Biedl Syndrome, and Leber's Syndrome are associated with R.P.	Optical aids, prisms. No known medical cure; genetic counseling is essential.	Slow, progressive loss in the visual fields that may lead to blindness.

Condition	*Affected Area*	*Cause*	*Visual Effects*	*Treatment*	*Prognosis*
Retinopathy of Prematurity	Retina (growth of blood vessels) and vitreous.	High levels of oxygen administered to premature infants; occasionally found in full-term infants.	Decreased visual acuity, severe myopia, scarring, and retinal detachment, with resultant visual field loss and possible blindness. Secondary complications: glaucoma and uveitis.	Optical aids and illumination control devices.	Poor, in severe cases, where further detachments can be expected in third decade
Strabismus	Muscle imbalance of rectus muscles holding eyes in correct position.	Hereditary, Injury	Diplopia or double vision. Reduced visual fields.	Prescription correction, eye patch on strong eye during early years, surgical correction to shorten elongated muscle, orthoptic training.	Can lead to blindness of the affected eye if untreated as a child.

Adapted from: Jose, RT(1984). Understanding low vision, New York: AFB Inc.

APPENDIX C: Organizations Serving Children and Youth With Visual and Multiple Disabilities

American Association of the Deaf-Blind
814 Thayer Avenue
Silver Spring, MD 20910

The American Association of the Deaf-Blind is a consumer organization of persons with deaf-blindness. It is involved in advocacy activities, conducts service programs, acts as a referral service, maintains a library of materials on deaf-blindness, and holds a convention annually for persons with deaf-blindness and their families.

American Council of the Blind—Parents (ACB)
c/o American Council of the Blind
1155 15th Street, N.W.
Suite 720
Washington, DC 20005
(202) 467-5081

The American Council of the Blind—Parents is a special interest affiliate of the American Council of the Blind (ACB). It promotes the sharing of resources and information and produces an informative newsletter for parents of children with blindness or visual impairments. ACB is a consumer organization that provides referrals, scholarships, leadership and legislative training, consumer advocacy support, assistance in technological research, consultative and advisory services to individuals, organizations, and agencies, and program development assistance.

American Foundation for the Blind (AFB)
15 West 16th Street
New York, NY 10011
(212) 620-2000 Hot Line (800 232-5473)

The AFB is a national nonprofit organization founded in 1921 to improve the standards of service for people who are blind and visually impaired. AFB provides direct assistance and referral services in partnership with over 700 specialized agencies, as well as public school, universities, senior centers, and businesses.

American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Ky. 40206
(502) 895-2405

The American Printing House for the Blind (APH) is a national organization that publishes books in braille, large-print, and audiotape formats; manufactures educational aids for persons who are blind or visually impaired; modifies and develops computer-access equipment and software; maintains an educational research and development program concerned with educational methods and educational aids; and provides a reference-catalog service for volunteer-produced textbooks in all media for students with visual impairments and for information about other sources of related materials.

Association for Education and Rehabilitation of the Blind and Visually Impaired (AER)
206 North Washington Street
Suite 320
Alexandria, VA 22314
(703) 836-6060

The Association for Education and Rehabilitation of the Blind and Visually Impaired (AER) is a professional membership organization that promotes all phases of education and work for persons of all ages who are visually impaired. AER organizes conferences and workshops, conducts certification programs for professionals working with people who are blind, maintains job-exchange services and a speakers' bureau, holds continuing-education seminars, and is involved in legislative and advocacy projects. AER also publishes RE:view*—a quarterly journal for professionals working in the field of blindness—and disseminates brochures and videotapes.*

The Association for Persons with Severe Handicaps (TASH)
11201 Greenwood Avenue, North
Seattle, WA 98133
(206) 316-8870

The Association for Persons with Severe Handicaps (TASH) advocates for services for persons with severe disabilities including those with dual sensory impairments. It also disseminates information, publishes a newsletter and a journal and holds an annual conference. Most states have a chapter of this organization.

The Blind Children's Fund
230 Central Street
Auburndale, MA 02166
(617) 332-4014

The Blind Children's Fund is an organization of parents and teachers that promotes activities and programs that benefit the growth, development, and education of children with visual impairments. It also publishes pamphlets and books and holds symposia.

Canadian National Institute for the Blind (CNIB)
1931 Bayview Avenue
Toronto, Ontario M4G 4C8
Canada
(416) 480-7580

The Canadian National Institute for the Blind (CNIB) fosters the integration of persons with blindness and visual impairments into the mainstream of Canadian life and promotes programs for the prevention of blindness.

DB-LINK
345 N. Monmouth Ave.
Monmouth, OR 97361
(800) 438-9376
Consumers (800) 854-7013 (TTY)
Businesses (503) 838-8776

DB-LINK is a federally funded information and referral service that identifies, coordinates, and disseminates information related to children and youth who are deaf-blind (ages 0 to 21 years).

Exceptional Teaching Aids
20102 Woodbine Avenue
Castro Valley, CA 94546
(415) 582-4859

Exceptional Teaching Aids manufactures and distributes educational materials and equipment for students with visual impairments, including tutorial and other educational software programs; braille materials for reading readiness, math readiness, and math practice; and books on cassette.

Guide Dogs for the Blind, Inc.
PO Box 1200
San Rafael, CA 94915

Training of guide dogs and training for persons with blindness to use dogs as guides.

Helen Keller National Center for Deaf-Blind Youths and Adults
111 Middle Neck Road
Sands Point, NY 11050
(516) 944-8900 (voice and TDD)

Helen Keller National Center for Deaf-Blind Youths and Adults provides services and technical assistance to individuals with deaf-blindness and their families and maintains a network of regional and affiliate agencies.

Howe Press
Perkins School for the Blind
175 North Beacon Street
Watertown, MA 02172
(617) 924-3434

Howe Press manufactures and sells the Perkins Brailler, as well as other tools, materials, and equipment for producing braille.

National Braille Association
422 Clinton Avenue
South Rochester, NY 14620
(716) 473-0900

The National Braille Association houses a collection of braille books for loan. A transcribing service for consumers and service providers also is available.

National Braille Press
88 Stephen Street
Boston, MA 02115
(617) 266-6160

The National Braille Press provides a contract transcription service for both print and braille materials.

National Coalition for Deaf-Blindness
c/o Perkins School for the Blind
175 North Beacon Street
Watertown, MA 02172
(617) 924-3434

The National Coalition for Deaf-Blindness advocates on behalf of persons with deaf-blindness and provides information to consumers and professionals.

National Early Childhood Technical Assistance System (NEC*TAS)
CB#8040
500 NCNB Plaza
Chapel Hill, NC 27599
(919) 962-2001

*The National Early Childhood Technical Assistance System (NEC*TAS) provides training and technical assistance to Part H and B state projects that are responsible for implementing P.L. 99-457.*

National Federation of the Blind (NFB)
Parents of Blind Children Division
1800 Johnson Street
Baltimore, MD 21230
(301) 659-9314

The National Federation of the Blind (NFB) is a national consumer organization with affiliates in all states. It monitors legislation affecting people with blindness, assists in promoting needed services, works to improve social and economic conditions of persons with blindness, provides evaluation of present programs and assistance in establishing new ones, offers scholarships to persons who are blind.

National Information Center for Handicapped Children and Youth (NICHY)
Box 1492
Washington, DC 20013
(202) 522-3332

The National Information Center for Handicapped Children and Youth is a free information service focusing on the needs of children and youth with disabilities. Its services include personal responses to specific questions, referrals, information packets, recruitment materials for careers in special education, publications, and technical assistance to groups of parents and professionals.

National Library Service for the Blind and Physically Handicapped (NLS)
Library of Congress
1291 Taylor Street, NW
Washington, DC 20542
(202) 707-5100; (800) 424-9100

The National Library Service (NLS) for the Blind and Physically Handicapped conducts a national program to distribute free reading materials in braille and on recorded disks and cassettes to persons with visual and physical impairments who cannot utilize ordinary printed materials.

National Organization for Albinism and Hypopigmentation (NOAH)
1500 Locust Street
Suite 1816
Philadelphia, PA 19102
(215) 454-2322

The National Organization for Albinism and Hypopigmentation (NOAH) publishes brochures and books to educate the public about albinism and hypopigmentation, encourages research on prevention and treatment of the diseases, holds conferences, maintains a speakers' bureau, and provides support to persons with albinism or hypopigmentation and their families.

National Society to Prevent Blindness
79 Madison Avenue
New York, NY 10016
(212) 684-3505

Readers Digest. Publishes *Readers Digest* in braille and on records for the Talking Book; may be secured from the American Printing House for the Blind.

Recording for the Blind
20 Roszel Road
Princeton, N. J. 08540
(609) 452-0606

Recording for the Blind lends taped educational textbooks at no charge to students with visual, perceptual and/or physical disabilities who are in elementary, high school, or college.

RP Foundation Fighting Blindness
(National Retinitis Pigmentosa Foundation)
1401 Mt. Royal Avenue
Baltimore, MD 21217
(301) 225-9400

The RP Foundation Fighting Blindness conducts public education programs, supports research related to the prevention and treatment of retinitis pigmentosa, maintains a network of affiliates across the country, and conducts workshops and referral and donor programs.

The Seeing Eye, Inc.
PO Box 375
Morristown, NJ 07960

The Seeing Eye, Inc. trains dog guides and instructs persons who are blind in their use.

Twin Vision Lending Library
American Action Fund for Blind Children and Adults
18440 Oxnard Street
Tarzana, CA 91356
(818) 343-2022

Twin Vision Lending Library serves parents and children with blindness by lending Twin Vision Books and other braille publications written on the preschool to junior-high reading level. Twin Vision Books publishes childrens' books that combine print and braille on facing pages so that people regardless of visual abilities can read together.

Xavier Society for the Blind
154 East 23rd Street
New York, NY 10010

The Xavier Society for the Blind provides free periodical and library service in Braille, large print, and cassette or open reel tape recordings to any interested readers who are blind or partially sighted. Catalogs available on request.

APPENDIX D: The Visual System
How We See

Since the visual system delivers so much information, it is important to understand how the eye and other parts of the visual system actually work. The following section describes these various parts and how they function to give us our sense of sight.

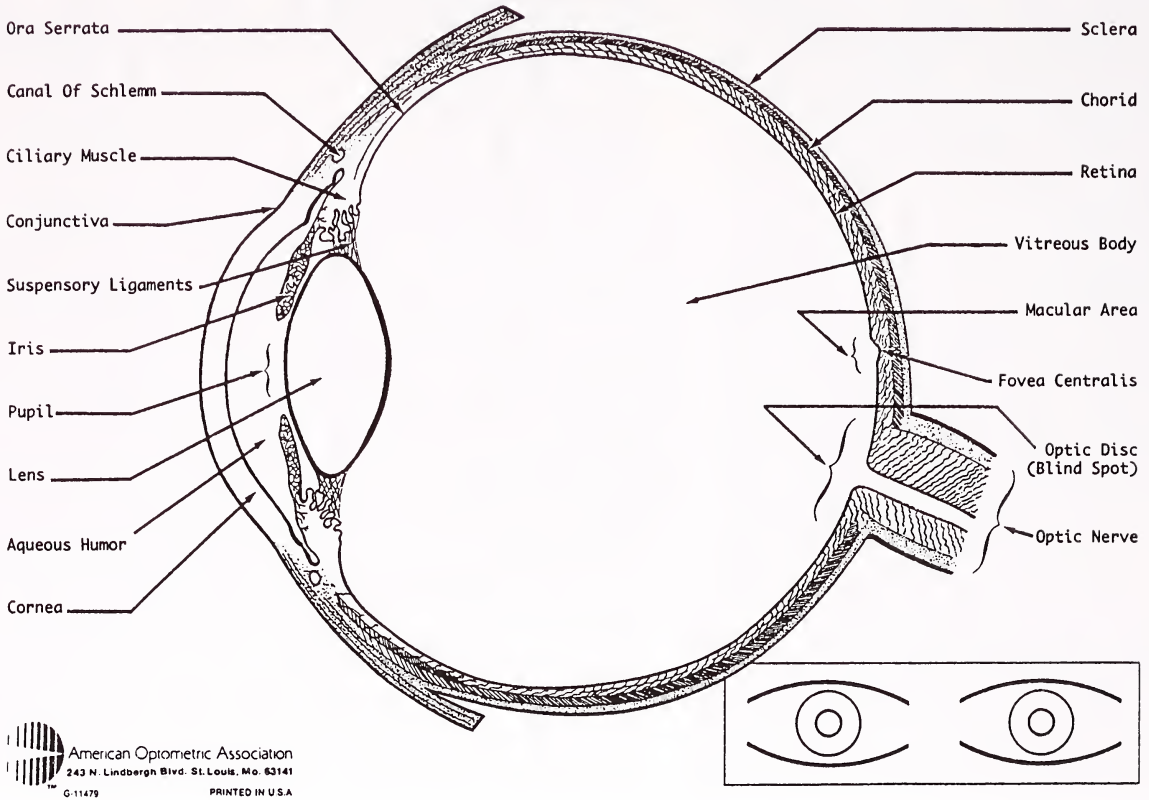
The Visual System

The way we see has been compared to a camera taking a picture. The process begins with either artificial or natural light. In the camera, the light enters through the lens. In the visual system, the eye acts as the lens. The lenses of both the camera and the eye then focus the light into an image. The camera records the image as a picture on film. The eye passes its image through a connective nerve called the optic nerve, where it is recorded in the brain. In both systems, there must be something to see, a means of receiving light and focusing the images, and finally a means of recording or storing the images.

Seeing

To see, light rays must first bounce off an object or person. Then, they must travel through space to the eye where they enter the outermost part of the eye called the cornea. The cornea (see Figure 1) is a clear, curved "window" designed to let in light rays and bend them on their path to the back of the eye. Once through the cornea, the light rays continue through a liquid known as the aqueous humor held in a small chamber in front of the pupil. The pupil is a tiny opening

Schematic Section of the Human Eye



American Optometric Association
243 N. Lindbergh Blvd. St. Louis, Mo. 63141
G-11479
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Figure 1.

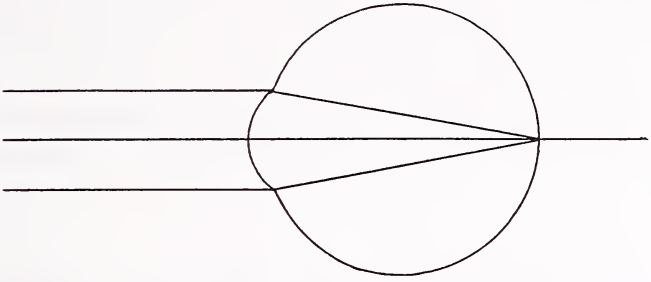
formed by the iris or colored part of the eye. The pupil looks black, and opens or closes to let in different amounts of light. The pupil widens when light levels are low, such as at night, and gets very small to keep out excessive light as in very bright sunlight. This quick, automatic response of the iris is an indication that the eye and the brain are working properly. You can watch how the iris works by looking at your own pupil in the mirror of the bathroom as you turn on and off the lights. A person who is unconscious does not show this automatic adjustment to the amount of light entering the eye. Though the eye needs light to see, excessive light (very intense sunlight) can cause damage. The iris closes and opens to control light levels. Sometimes making the pupil as small as possible does not keep the amount of light entering the eye low enough. Wearing sunglasses can aid the iris in this situation.

As light passes through the pupil opening, it enters the inner eye. Here the light rays encounter the lens of the eye (see Figure 1). Like the cornea, the lens is clear and curved. This design allows light to pass through while further bending the light rays so they converge or come to a point at the back of the eye. The lens itself changes shape. It gets thicker when a person examines something up close and gets thinner when viewing something far away. The lens structure is controlled by very small muscles and nerves that adjust the lens to bend the light rays more when looking at things close up (near vision) or, bend them less for looking at things far away (far vision). This change in the lens is called accommodation and occurs automatically. As a person ages, this adjustment becomes more and more difficult until finally seeing things at a close range becomes blurry. At this point, most people wear glasses. These lenses, worn outside on the face, help people see clearly while reading, sewing, or doing any *near* vision work.

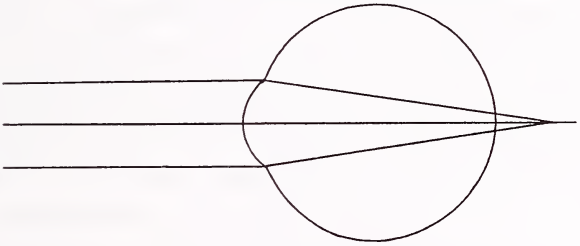
Figure 2. Optics of Focus (Chalkley, 1982)

- Proper focus on retina (emmetropia)
- Farsightedness (hyperopia)
- Nearsightedness (myopia)

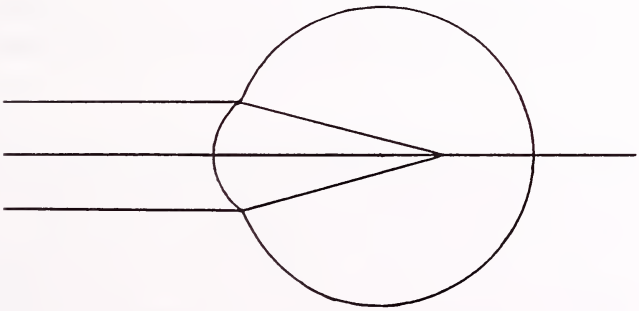
Your Eyes



Proper focus on retina



Farsightedness



Nearsightedness

The natural process of aging causes some visual problems as the eye loses its flexibility. There are a number of other causes. Some of the most common visual impairments involve the eye's inability to converge or bend light rays so they come to a point on the back of the eye. When the eye can not bend light rays enough or, bends them too much, the problem is called a refractive error. If the light rays converge too soon, (see Figure 2), the refractive problem is called myopia. A person who is myopic may be able to see quite well up close, but will have difficulty seeing far away. Many people are myopic and are able to use glasses or contact lenses to correct the condition. The corrective lenses prevent the light from bending too soon allowing them to converge at the retina.

The opposite problem occurs when the light rays are not bent enough. This means they go past the point of convergence on the back of the eye (see Figure 2). This problem is called hyperopia and means that the person can see at a distance, but has considerable problems seeing up close. Although most people develop refractive problems as they age (mid to late 40s), some children are born with these conditions. They may need glasses or contact lenses right away. Sometimes, because the eye of a young child is still developing (to approximately age 8), the size of the eye will change and the problem will be outgrown. The eye has then automatically corrected itself as it developed, gaining the bending strength it needs.

Once the light rays pass the system of lenses, including any corrective ones prescribed by the eye doctor (ophthalmologist or optometrist), they enter the largest part of the entire eye. Known as the vitreous humor (see Figure 1), this clear, jelly-like substance fills the globe of the eye helping to hold

its shape. Like the cornea, aqueous humor, and lens, this part of the eye also must be clear in order for the light rays to continue on their journey to the retina at the back of the eye. The retina (see Figure 1) is where the light rays converge. This part of the eye is made up of many neural cells that eventually come together to form the optic nerve. At the retina, information from the light rays is transformed so it can be conveyed to the brain. The macula, one part of the retina, is particularly crucial to the transformation process. The macula is located right next to the optic nerve. It contains the majority of the retinal cells called cones. These cone cells require a great deal of light to function properly. They allow us to clearly see detail as well as color. The other neural cells in the retina are called rods. They serve a different function. They take over when lighting is diminished (dark room or at dusk). These rod cells also allow us to detect movement and give us what is called our peripheral vision. Peripheral vision is what we see on the outer edges of our visual field. This is sometimes referred to as catching something "out of the corner of our eye." Although the rods do not require as much light as the cones, they also are not as useful for reading or doing any kind of close up work. Peripheral vision is much more important for movement in space and becoming aware of things as they approach.

Together the rod and cone cells of the retina give us our full visual range. As light rays strike the retina they are converted to neural energy and the information is carried via the optic nerve to the back of the brain. Here, at the occipital region of the brain, the neural information is interpreted according to the way we have learned to use visual information.

Sometimes the eye and the process of getting information to the brain can be fully functioning, but the person is unable to understand or act on what is seen. When this happens the person has not *learned* to "see" what is looked at or, some part of the brain has been severely damaged and cannot process information properly. Visual perception is a term used when the brain is able to interpret and understand the images taken in by the eye. In other words, if light rays bouncing off a dog are carried through an unimpaired eye, converted to neural energy by the cones and rods of the retina, brought to the occipital lobe of the brain by the optic nerve and understood as an image of a dog by the brain because the person has had past experiences with dogs, then it can be said that the person has "seen" a dog.

The ability to make the connection between what is looked at and what is perceived is an important one. To understand what the eye is observing a person must learn to interpret information. This requires pulling up similar images from past experiences to use for comparison. For children with limited vision and/or limited experiences, the importance of teaching children how to look, as well as how to understand what they are looking at, is critical.

Visual Skills: How the Eye Works

People engage in a wide range of visual skills throughout each day. To participate in most life situations, different visual skills are automatically applied without a great deal of effort on the part of the individual. However, for children with a severe visual loss, including those with multiple disabilities, some of these basic visual skills may require actual instruction to become useful for the individual. The major visual skills will be described in the following pages with specific examples provided to clarify each skill.

Locating

For the eye to detect visual information, it must first locate something to look at in space. Often locating visual information is accompanied by information gained from other senses, such as hearing or smell. For instance, a loud bang might cause someone to look in that direction to try and locate what created the sound. The smell of popcorn may prompt some people to look for the source. Not only are other senses involved in locating visual information, but the ability to move the entire body or just the head in the desired direction is another skill that must be integrated into the process of locating. For children with severe physical disabilities that hinder movement, learning to visually locate objects may be quite difficult. In addition, children with severe hearing impairments also may experience problems because they cannot benefit from the added information that sound provides in the process of visually locating.

Fixating

Before an individual can obtain enough visual information to identify an object or person, the eye must fixate long enough on the stimulus for the visual system to work as described above. We are exposed to millions of bits of visual information on a daily basis. We cannot process all of this information. Therefore much of what is seen is not meaningful or recognized. Instead we decide to fixate on what is important in our lives: the faces of people we know, pets, words on pages we want to read, etc.

Much of what is available for us to view is not looked at by the visual system. We choose not to see it. For the child with a short attention span or an inability to concentrate, the

problem of fixating is very real. These children may need help finding the important visual information. When that information is blurred or the ability to process is impaired, the child may have difficulty concentrating for any length of time. This child may experience problems staying focused during an activity—jumping from object to object or showing little interest in what is happening.

Scanning

Often we need to quickly look over visual information to determine what is meaningful for us to find. The information is stationary and our eyes move across the information systematically so as not to miss anything of importance. People visually scan information when they are reading, looking for a familiar face in a crowd, choosing a birthday card from the card rack, and selecting the desired ice cream flavor. For children with a limited visual field and/or poor visual acuity, scanning can be difficult. These children may not even realize that a number of options are available to them.

Not only is scanning a necessary skill for reading, it is also a critical skill for making choices. Without the ability to scan, children may not be aware of all their options. As a result they may not learn the skill of good decision making. These children may need to learn how to use their vision to scan information to make decisions about what they want.

Tracking

Sometimes visual information is not stationary. When visual stimuli is moving (such as in a game of basketball), the eyes must track the moving objects. Sometimes tracking is pos-

sible when just the eyes move to follow the object and other times the person must move his/her head to keep the object in sight. Tracking is a valuable skill, because much of what we see does move. Many sports require the ability to visually track a ball during play. Playing follow the leader, watching traffic to determine when it is safe to cross a street, and watching a ballet all require the ability to track moving objects or people.

For some children the skill of tracking may not be present. These children may miss considerable information, which in turn makes it difficult for them to perform as expected. Specific instruction during meaningful activities that require tracking will be necessary to help these children learn to use their eyes to follow moving objects and people.

Shift of Gaze

The visual skill called shift of gaze is critical for making choices. Shifting gaze occurs when the eye fixates on first one object and then on another. This skill is most obvious when two or three choices are presented to someone at the same time. The person must carefully look at each option before making a choice. Without this ability it would be very difficult to make meaningful decisions, because all options would not be perceived.

Most people shift gaze constantly throughout each day without much awareness of this basic visual skill. However, some children with multiple disabilities and visual problems have difficulty learning this skill. They may remain so fascinated by one object that looking at other objects does not occur.

These children will need to be taught how to shift their gaze to perceive all necessary information.

Eye-Hand Coordination

The integration of the visual system and the motoric system (using one's body) allows an individual to perform many meaningful activities. Eye-hand coordination is the ability to see and then physically act on what is seen. This might occur by moving the hand toward and successfully coming in contact with the observed item. Eye-hand coordination provides a strong foundation for other learning, because it promotes the child's ability to better understand what is seen by adding the information obtained from the sense of touch. At a very early age children see their parents, toys, food, etc., and reach out to touch these so as to clarify what they see.

For a child with physical and visual impairments eye-hand coordination may be greatly restricted, further limiting the child's natural curiosity and making learning that much more difficult. Adaptations, such as bringing things close or helping these children explore, may be needed to enhance learning.

APPENDIX E: Terminology
Words You May See or Hear

Accommodation - the ability of the lens to adjust its shape in order to produce a clear image on the retina.

Amblyopia - dimness of vision without any apparent cause.

Ametropia - refractive error such as myopia and astigmatism in which the eye does not focus the image on the retina.

Anterior Chamber - space in the front portion of the eye between the cornea and iris.

Aqueous Humor - clear watery fluid that fills the anterior chamber.

Buphthalmos - large eyes secondary to glaucoma.

Cataract - cloudiness of the lens.

Choroidoretinitis - inflammation of the choroid and retina.

Cones - cone-shaped nerve endings in the retina that work best in daylight, allowing one to make out details and colors.

Cornea - the clear, curved covering on the front of the eye.

Depth Perception - the blending of two slightly dissimilar images from the two eyes to form one image.

Diopter - metric unit used to denote the strength of the eye or lens.

Diplopia - double vision.

Distance Vision - ability to distinctly perceive objects at a distance, usually 20 feet.

Divergence - turning outward of both eyes at the same time away from each other.

Electroretinogram - (ERG) a record for the diagnosis of retinal disease of change in the retina after stimulation by light.

Esophoria - a tendency of the eye to turn inward.

Esotropia - observable turning in of one or both eyes.

Exophoria - a tendency of the eye to turn outward.

Exotropia - observable turning outward of one or both eyes.

Fixation - focusing the eye directly on an object so its image centers on the fovea.

Fovea - a small area on the retina, responsible for central vision and color vision.

Glaucoma - disease associated with excessive pressure within the eye.

Hemanopsia - defective vision in half the visual field.

Intraocular Pressure - (IOP) the pressure of the fluid within the eye.

Iris - colored circular membrane that controls the size of the pupil.

Legal Blindness - central vision does not exceed 20/200 in the better eye with correcting lenses or the field of vision is limited to a visual field no greater than 20 degrees.

Light Adaptation - power of the eye to adjust to variations in the amount of light.

Low Vision Aids - optical devices (e.g., magnifiers) useful to some people with visual impairments.

LP - notation used by eye specialists to indicate light perception or the ability to distinguish light from dark.

LPP - notation used by eye specialists to indicate light projection or the ability to perceive and localize the direction from which light comes.

Macula - area at the center of the retina that surrounds the fovea and is responsible for clearest central vision.

Near Vision - the ability to perceive objects distinctly at normal reading distance (between 14" to 16" from the eye).

NLP - (no light perception) notation used by eye specialists to indicate inability to distinguish light from dark.

Nystagmus - involuntary, regular, rapid movement of the eye.

OD - notation used by eye specialists to designate the right eye.

Ophthalmologist - a doctor of medicine (M.D.) licensed to practice medicine and surgery who specializes in the diagnosis and treatment of diseases and defects of the eye.

Opthalmoscope - an instrument for examining the interior of the eye.

Optician - one who fits, adjusts, and dispenses glasses.

Optic Nerve - special nerve of sight beginning in the retina that carries the messages of the retina to the brain.

Optometrist - a doctor of optometry. A licensed non-medical practitioner who measures refractive errors and eye muscle disturbances and prescribes glasses, low vision aids, and exercises.

O.S. - notation used by eye specialists to indicate the left eye.

O.U. - notation used by eye specialists to indicate both eyes together.

Photophobia - abnormal sensitivity to light.

Posterior Chamber - space between the back of the iris and the front of the lens.

Ptosis - a drooping of the upper eyelid.

Pupil - the opening in the center of the iris through which light enters the eye.

Refractive Error - a defect in the eye that prevents light waves from being focused on the retina.

Retina - innermost coat of the eye containing light sensitive nerve cells (e.g., rods and cones) connecting with the brain through the optic nerve.

Retinal Detachment - separation of the retina from the underlying layers.

Retinoscopy - use of a handheld instrument to measure refractive error.

Rods - light-sensitive nerve endings at the edge of the retina which detect movement and work best in the dim light.

Sclera - the white part of the eye that forms a tough protective coat.

Scotoma - blind area in the visual field.

Strabismus - inability of both eyes to look directly at an object at the same time.

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